

# **Lecture Notes in Artificial Intelligence**

**12316**

Subseries of Lecture Notes in Computer Science

Series Editors

Randy Goebel

*University of Alberta, Edmonton, Canada*

Yuzuru Tanaka

*Hokkaido University, Sapporo, Japan*

Wolfgang Wahlster

*DFKI and Saarland University, Saarbrücken, Germany*

Founding Editor

Jörg Siekmann

*DFKI and Saarland University, Saarbrücken, Germany*


More information about this subseries at <http://www.springer.com/series/1244>


Samarth Swarup · Bastin Tony Roy Savarimuthu (Eds.)

# Multi-Agent-Based Simulation XXI

21st International Workshop, MABS 2020  
Auckland, New Zealand, May 10, 2020  
Revised Selected Papers

*Editors*

Samarth Swarup   
University of Virginia  
Charlottesville, VA, USA

Bastin Tony Roy Savarimuthu   
Department of Information Science  
University of Otago  
Dunedin, New Zealand

ISSN 0302-9743                      ISSN 1611-3349 (electronic)  
Lecture Notes in Artificial Intelligence  
ISBN 978-3-030-66887-7              ISBN 978-3-030-66888-4 (eBook)  
<https://doi.org/10.1007/978-3-030-66888-4>

LNCS Sublibrary: SL7 – Artificial Intelligence

© Springer Nature Switzerland AG 2021

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG  
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Preface

The Multi-Agent-Based Simulation (MABS) Workshop series, which began in 1998, aims to bring together researchers interested in MAS engineering with researchers focused on finding efficient solutions to model complex social systems, in such areas as economics, management, organizational and social sciences in general. Its scientific focus lies at the confluence of social sciences, and multi-agent systems, with a strong application/empirical vein, and its emphasis is on (i) exploratory agent-based simulation as a principled way of undertaking scientific research in the social sciences, and (ii) using social theories as an inspiration for new frameworks and developments in multi-agent systems.

The 21st edition of the workshop, collocated with the 19th International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS), was held virtually (through Zoom) due to the COVID-19 lockdown, on 10th May, 2020. A total of 12 papers were submitted to the workshop and nine were accepted after peer review. These papers were reviewed by two or more PC members using a single-blind review method. This workshop also featured invited talks on the topic of *the role of multi-agent-based simulation in addressing global problems* from Professor Frank Dignum, Dr Maite Lopez-Sanchez, Dr Cristian Jimenez, Dr Mario Paolucci, Dr Jason Thompson, Ms. Fatema T. Johora and Ms. Kaidi Wang. Also, a general discussion centered around the same topic was held. About 25 participants attended the workshop.

This volume represents 8 revised papers (out of 9 accepted for the workshop), which were extended and revised based on the peer reviews received from the workshop. The revisions made to the papers were reviewed by one of the workshop chairs, and this formed the second round of peer review. We are confident this process has resulted in high-quality papers.

The workshop could not have taken place without the contribution of many people. We are very grateful to our invited speakers as well as to all the MABS 2020 participants who took part in the discussions. We are also very grateful to all the members of the Program Committee for their hard work. Thanks also go to Jaime Sichman and Mehdi Dastani (AAMAS 2020 workshop chairs), and to Amal El Fallah Seghrouchni and Gita Sukthankar (AAMAS 2020 general co-chairs). We also thank EasyChair for the use of their conference management system.

November 2020

Samarth Swarup  
Bastin Tony Roy Savarimuthu

# Organization

## Chairs

Samarth Swarup  
Bastin Tony Roy  
Savarimuthu

University of Virginia, USA  
University of Otago, New Zealand

## Steering Committee

Frédéric Amblard  
Luis Antunes  
Paul Davidsson  
Nigel Gilbert  
Tim Gulden  
Emma Norling  
Mario Paolucci  
Jaime Simão Sichman  
Takao Terano

Toulouse 1 Capitole University, France  
University of Lisbon, Portugal  
Malmö University, Sweden  
University of Surrey, UK  
George Mason University, USA  
Manchester Metropolitan University, UK  
National Research Council, Italy  
University of São Paulo, Brazil  
Tokyo Institute of Technology, Japan

## Program Committee

Diana Francisca Adamatti  
Frédéric Amblard  
Luis Antunes  
João Balsa da Silva  
Federico Bianchi  
Sung-Bae Cho  
Paul Davidsson  
Frank Dignum  
Graçaliz Dimuro  
Francisco Grimaldo  
László Gulyás  
Rainer Hegselmann  
Ruth Meyer  
Jean-Pierre Müller  
Luis Gustavo Nardin  
Paulo Novais  
Mario Paolucci  
William Rand  
Juliette Rouchier  
Klaus G. Troitzsch  
Natalie van der Wal

Universidade Federal do Rio Grande, Brazil  
University Toulouse 1 Capitole, France  
University of Lisbon, Portugal  
University of Lisbon, Portugal  
University of Milan, Italy  
Yonsei University, South Korea  
Malmö University, Sweden  
Umeå University, Sweden  
Universidade Federal do Rio Grande, Brazil  
University of Valencia, Spain  
Eötvös Loránd University, Hungary  
University of Bayreuth, Germany  
Manchester Metropolitan University, UK  
CIRAD, France  
National College of Ireland, Ireland  
University of Minho, Portugal  
Institute of Cognitive Sciences & Technologies, Italy  
North Carolina State University, USA  
CNRS-LAMSADE, France  
University of Koblenz-Landau, Germany  
Delft University of Technology, The Netherlands

Harko Verhagen  
Neil Yorke-Smith

Stockholm University, Sweden  
Delft University of Technology, The Netherlands

## **Additional Reviewers**

Leonardo Emmendorfer  
Chathika Gunaratne  
Chathura Jayalath

# Contents

Adaptivity in Distributed Agent-Based Simulation: A Generic Load-Balancing Approach . . . . .	1
<i>Stig Bosmans, Toon Bogaerts, Wim Casteels, Siegfried Mercelis, Joachim Denil, and Peter Hellinckx</i>	
Trajectory Modelling in Shared Spaces: Expert-Based vs. Deep Learning Approach? . . . . .	13
<i>Hao Cheng, Fatema T. Johora, Monika Sester, and Jörg P. Müller</i>	
Towards Agent-Based Traffic Simulation Using Live Data from Sensors for Smart Cities . . . . .	28
<i>Yan Qian, Johan Barthelemy, and Pascal Perez</i>	
Design and Evaluations of Multi-agent Simulation Model for Electric Power Sharing Among Households . . . . .	41
<i>Yasutaka Nishimura, Taichi Shimura, Kiyoshi Izumi, and Kiyohito Yoshihara</i>	
Active Screening on Recurrent Diseases Contact Networks with Uncertainty: A Reinforcement Learning Approach. . . . .	54
<i>Han Ching Ou, Kai Wang, Finale Doshi-Velez, and Milind Tambe</i>	
Impact of Meta-roles on the Evolution of Organisational Institutions . . . . .	66
<i>Amir Hosein Afshar Sedigh, Martin K. Purvis, Bastin Tony Roy Savarimuthu, Maryam A. Purvis, and Christopher K. Frantz</i>	
Optimization of Large-Scale Agent-Based Simulations Through Automated Abstraction and Simplification . . . . .	81
<i>Alexey Tregubov and Jim Blythe</i>	
Improved Travel Demand Modeling with Synthetic Populations . . . . .	94
<i>Kaidi Wang, Wenwen Zhang, Henning Mortveit, and Samarth Swarup</i>	
Author Index . . . . .	107